RUBSTAKE - RUBBER WOOD STAKE FOR DETECTING SUBTERRANEAN TERMITES IN PEAT SOIL

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Termite infestation in oil palm, especially in peat soil, has become a serious problem due to rapid expansion of the industry. Termites were first been reported as an occasional pest on mineral soils. Later, they were documented as a major pest to oil palm on peat (Zulkefli *et al*., 2000).

Many termite species inhabit peat soil. Most of them are wood decomposers but the most destructive species (from family Rhinotermitidae) are usually subterranean feeding on living plant tissues. The common species in oil palm plantations are *Coptotermes curvignathus* and *Macrotermes gilvus* (*Figures 1a* and *1b*). The former may destroy the palm while the latter only disturbs the roots (Sudharto *et al*., 1991).

Termite infestation has been reported as early as 12 months after field planting (Lim and Silek, 2001). The pest may kill more than 5.3% of the palms in a year (Basri *et al*., 2003). Early detection is essential to avoid the spread of the pest. Their habits, especially the lack of visible nests in subterranean termites, make them difficult to detect before infestation. After infestation, termite can be detected from their mud trails formed on the palm trunks (*Figure 1c*). With young palms (less than one year), the infestation may reach the petioles and be fatal to the newly planted palm.

Figure 1. Termite infestation on oil palm (a), Macrotermes gilvus *mound on oil palm base (b) and fresh mud trail of* C. curvignathus *(c).*

IDENTIFICATION OF TERMITES

Termite identification is a requisite in their management. The large number of species and lack of taxonomic understanding may lead to incorrect and incomplete identifications. Without understanding their biology and the likely damage to be caused, management would be difficult.

Coptotermes is the important genus in oil palm plantations. The common species are *C. curvignathus*, *C. sepangensis* and *C. kalshoveni*. Other species such as *Schedorhinotermes*, *Nasutitermes*, *Macrotermes* and *Globitermes* are not pests to oil palm because they only feed on dead wood.

Coptotermes is easy to detect on oil palm by their mud trails formed on the trunks and petioles. The soldier of *Coptotermes* species will secrete a white fluid when disturbed (*Figure 2*).

Figure 2. The soldier of Coptotermes curvignathus *secretes a white fluid when disturbed.*

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The first foliar symptoms are yellowing and dying of the lower fronds (Khoo *et al.*, 1991). Even at this stage, recovery is difficult because most of their meristematic system would have been already affected. Accumulation of soil at the shoot and holes at the frond bases will cause the death of the palm within a month (*Figures 3a* and *3b*). The incidences occur when the soil dries up and their food source, especially the logs buried in the soil, decompose.

Figure 3. Serious infestation of termites on oil palm shoot (a) and a row of palms killed by termites (b).

TERMITE DETECTION USING RUBSTAKE

A rubber wood (*Hevea brasiliensis*) stake (Rubstake) was used for termite detection at MPOB Sessang. The dimensions were 30 cm x 5 cm x 5 cm. All the stakes were oven dried at 80˚C for 24 hr, weighed and numbered before use. A string was attached on top of each stake for easy handling and collecting.

A total of 30 stakes were used in each plot of 250 m^2. The stakes were driven into the soil 5 m apart. The dimensions of a plot was 20 m x 30 m (5 x 6 stakes). The plots were replicated three times. The stakes examined in two weeks and taken out after one month (*Figures 4a* and *4b*). The times were chosen based on a preliminary study which showed visible damage after only two weeks. If more than one month, some of the stakes would have been totally consumed by the termite (*Figure 4c*). Identification of the species would then be impossible due to unavailability of the damage and termites.

Three sites were selected for this experiment. The location was deep peat (mature palms), medium deep peat (mature palms) and deep peat (younger palms). The plots were located between the field drains to avoid the Rubstakes being attacked from both sides of the plots. Replication was three times.

After one month, each Rubstake was collected and replaced. The termites on each stake were collected and sample specimens placed in a glass vial containing 70% ethanol. Each vial would have a worker and soldier for identification in the laboratory under a microscope.

The stakes were brought to the laboratory, washed and oven dried at 80˚C for 24 hr, cooled and weighed again. The weight difference of each stake was used to assess the wood consumption by the termites.

Figure 4. Rubstake infested with termites after one month in peat soil (a), workers of C. curvignathus *on Rubstakes (b) and damage on Rubstakes by* C. curvignathus *(c).*

RESULT

Table 1 shows that the immature palms had more of the destructive *Coptotermes curvignathus* after three rounds of sampling. Initially, only 42.2% of the 90 Rubstakes were attacked, half by *C. sepangensis*, *C. kalshoveni*, *Macrotermes gilvus, Schedorhinotermes* and *Nasutitermes.* The populations of the other species decreased over time, over taken by *C. curvignathus.* The incidence of *C. curvignathus* double from the first to the second and third rounds of sampling.

TABLE 1. TERMITE SPECIES ATTACKING RUBSTAKES AT MPOB SESSANG OVER TIME

Round of sampling	1st round (n=30)		2nd round (n=30)		3rd round (n=30)	
Species of termite	*Cc*	*Os*	*Cc*	*Os*	*Cc*	*Os*
Palm age/peat depth	% of wood stakes with termite species					
Mature/medium	47.8	15.5	58.9	2.2	50.0	0
Mature/deep	65.6	13.3	66.7	10.0	77.8	1.1
Young/deep	42.2	43.3	90.0	5.6	85.6	11.1

Notes: Cc - *Coptotermes curvignathus.*
Os - Other species – *M. gilvus, Schedorhinotermes* and *Nasutitermes.*

There was less activity in the medium than deep peat. The numbers of Rubstakes with destructive termite species were almost the same at each sampling. After nine months of study, the population was dominated by *C. curvignathus.* The same trend occurred on deep peat; the percentage decreased in the second round and only one stake was found with *Macrotermes gilvus* in the last round of sampling.

On deep peat at MPOB Sessang, 84% of the Rubstakes under the young palms were infected with termites compared to only 26.6% for the mature palms. In the one month period, the termites consumed 36% to 45.6% of the Rubstakes. The weight of Rubstake consumed was 6.1 g to 490.2 g. Seven species of termites were found on the Rubstakes *(Figure 5).*

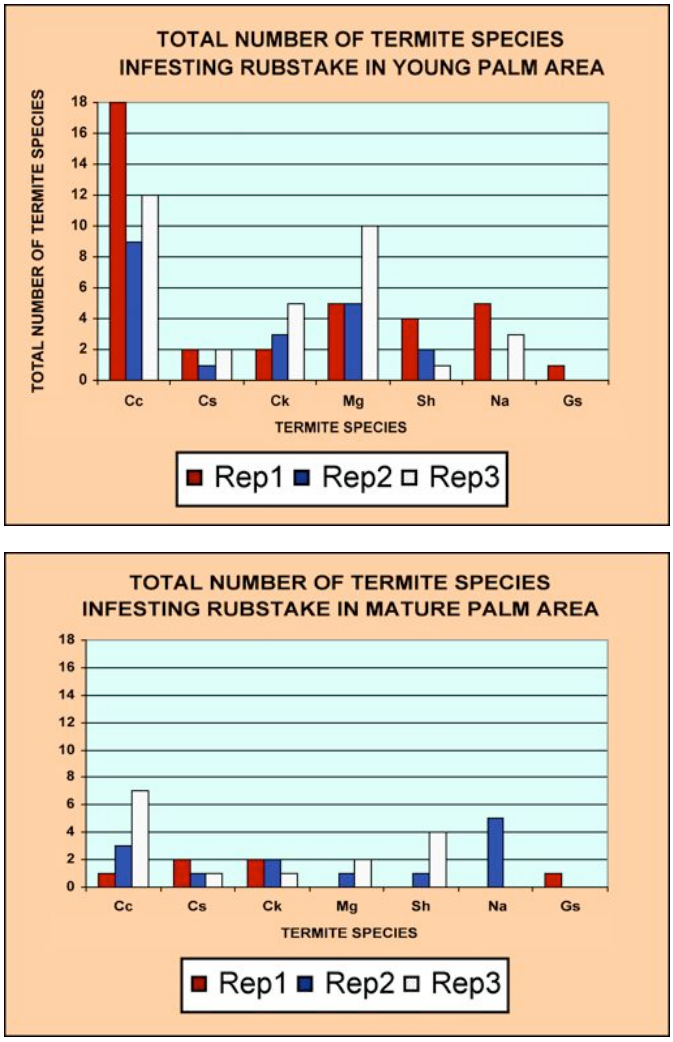

Figure 5. Total number of termite species infested rubber wood stake in young and mature palm area.

Notes:
Cc - *Coptotermes curvignathus.*
Cs - *Coptotermes sepangensis.*
Ck - *Coptotermes kalshoveni.*
Mg - *Macrotermes gilvus.*
Sh - *Schedorhinotermes.*
Na - *Nasutitermes.*
Ga - *Globitermes sulphureus.*

The dominant species was *C. curvignathus* which infested about 51.3% and 29.4% of the areas. Identification can be done by comparing the head size and shape of mandibles of the soldier termite (*Figure 6*).

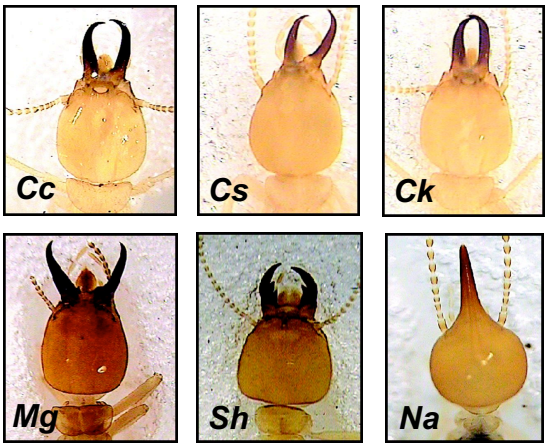

Figure 6. Head and mandible shapes of six termite soldiers.

BENEFITS

The Rubstake is simple and easy to use for detecting termites in peat soil. The results can be used to monitor the termite population at an early stage of planting and would be useful for post-treatment monitoring.

CONCLUSION

Rubstake is recommended for detecting *C. curvignathus* as it is cheap and can reduce the cost and time for managing the pest.

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